Analysis of Arctic Cod Stomach Contents from the Beaufort Shelf, July and September, 1984

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TABLE OF CONTENTS

	Page
ABSTRACT/RÉSUMÉ	iv
INTRODUCTION	1
MATERIALS AND METHODS	1
RESULTS	1
Feeding analysis	1
Parasites	1
ACKNOWLEDGMENTS	1
REFERENCES	2

LIST OF TABLES

Table		Page
1	Sampling dates, locations, depths and number of Arctic cod caught during trawling surveys on the Beaufort Shelf, July and September, 1984	3
2	Occurrence and counts (in brackets) of food items from Arctic cod (Boreogadus saida) caught during July, 1984, from all stations	4
3	Occurrence and counts (in brackets) of food items from Arctic cod (Boreogadus saida) caught during September, 1984, from all stations	5
4	Feeding analysis of Arctic cod (Boreogadus saida) by station during the July, 1984, survey	6
5	Feeding analysis of Arctic cod (Boreogadus saida) by station during the September, 1984, survey	7
6	Occurrence of the digenetic trematodes Brachyphallus crenatus and Lecithaster sp., from the digestive tract of Arctic cod caught on the Beaufort Shelf during July and September, 1984	8

LIST OF FIGURES

Figure		Page
1	Study area - 1984 trawling survey	9
2	General locations of Arctic cod catches - July and September, 1984	10

ABSTRACT

Lacho, G. 1986. Analysis of Arctic cod stomach contents from the Beaufort Shelf, July and August, 1984. Can. Data Rep. Fish. Aquat. Sci. 614: iv + 10 p.

Arctic cod (Boreogadus saida Lepechin) from bottom trawl catches in the southern Beaufort Sea during July and September, 1984, were analyzed for food items. Copepods appear to be an important part of the diet of cod captured during this study, especially Pseudocalanus elongatus from the July survey and Limnocalanus macrurus from fish caught in September trawls. Results of feeding analysis for fish caught off the Tuktoyaktuk Peninsula and Herschel Island are summarized in this report.

Key words: bottom trawling; food organisms; copepods; Pseudocalanus elongatus; Limnocalanus macrurus; Tuktoyaktuk Peninsula; Herschel Island.

RÉSUMÉ

Lacho, G. 1986. Analysis of Arctic cod stomach contents from the Beaufort Shelf, July and August, 1984. Can. Data Rep. Fish. Aquat. Sci. 614: iv + 10 p.

Des saïdas francs (Boreogadus saida Lepechin) provenant de captures faites au chalut de fond dans le sud de la mer de Beaufort au cours de juillet et de septembre 1984 ont été soumis à des analyses afin d'établir la composition de leur alimentation. Il semble que les copépodes constituent une partie importante du régime alimentaire des saïdas francs capturés au cours de cette étude, en particulier les Pseudocalanus elongatus, chez les sujets capturés en juillet, et les Limnocalanus macrurus, chez les sujets capturés en septembre. Les résultats de l'analyse du régime alimentaire du poisson capturé au large de la péninsule de Tuktoyaktuk et de l'île Herschel sont résumés dans ce rapport.

Mots-clés: chalutage de fond; organismes alimentaires; copépodes; Pseudocalanus elongatus; Limnocalanus macrurus; péninsule de Tuktoyaktuk; île Herschel.

INTRODUCTION

In 1984, the Department of Fisheries and Oceans, Western Region, commenced offshore studies of marine resources in the southern Beaufort Sea utilizing the charter vessel "Sequel" out of Tuktoyaktuk, Northwest Territories (NWT). Stations were sampled off the Tuktoyaktuk Peninsula, the Mackenzie Delta and Yukon coast in the vicinity of Herschel Island. Along with various biological and oceanographic investigations on the Beaufort Shelf, bottom trawling, utilizing a small otter trawl, was done to further the information base on fish resorces from both nearshore and offshore areas. Arctic cod, Boreogadus saida Lepechin, was one of the species captured. This report summarizes the results of food item analysis from Arctic cod caught during the surveys for July and September, 1984.

MATERIALS AND METHODS

The study area is shown in Fig. 1. Thirty-minute trawls along selected transects were done using a 4.9 m headline otter trawl with 0.6 mm mesh cod end. Coordiantes for sampling transects were obtained from a Magnavox Model MX4102 satellite navigtor and are found in Table 1 for the July and September surveys. General locations for sampling stations are found in Fig. 2. Oceanographic data can be found in Hopky et al. (1986).

Nineteen transects were trawled between July 14 and 25 at depths ranging between 10 and 30 meters. Arctic cod from seven of these transects were retained for feeding analysis. Cod from nine of the 12 transects trawled between September 7 and 9 were analyzed.

All cod retained after each haul were frozen whole for later investigation. Analysis of stomach and intestine samples was done by Invertebrate Research Associates, Winnipeg, Manitoba.

RESULTS

FEEDING ANALYSIS

A total of 167 cod were caught during the July survey and 59 of these were retained for feeding analysis. Mean total length for these fish is 74.4 mm with a range of 15.0-109.0 mm. Two-hundred and five Arctic cod were captured during the September cruise and 74 were analyzed for food items. Fish analyzed from September catches had a mean total length of 41.5 mm and ranged between 26.0 and 76.0 mm.

Overall results of food item analysis for July and September are found in Tables 2 and 3 respectively. Individual station results are listed in Tables 4 and 5.

Nineteen fish from the July survey were found to have empty stomachs and intestines. From the remaining 40 stomachs, 22 contained copepods and/or copepod remains. Psuedocalanus elongatus was the most numerous of the identified copepods. Although occurring in only nine stomachs, the total count for this species was 219 individuals from transects 8403 A-C and 8404 A-C. Amphipods were the second most utilized food item followed by mysids, crustaceans and larval fish. There appears to be a higher diversity of not only copepods but of other food types from the offshore transects at stations 8403 and 8404 (Table 4).

September caught fish also fed extensively on copepods. Copepod remains were found in 41 of the stomachs analyzed. Limnocalanus macrurus was found in 27 fish for an overall count of 508. This copepod had the highest count from cod at stations 8401 and 8405 (Table 5). Both stations are in nearshore areas off Tuktoyaktuk Peninsula. Amphipod remains and Apherusa glacialis were next in importance. Some feeding on unidentified crustaceans and mysids was also found. Only four fish were empty.

Other studies have found copepods to be important in the diet of Arctic cod. Hognestad (1968) noted that stomachs from Barents Sea samples were filled with the copepod Calanus finmarchicus. Lowry and Frost (1981) describe Arctic cod from the Alaskan Beaufort and northeastern Chukchi Sea feeding mainly on calanoid copepods and the amphipod Apherusa glacialis, which was found in a few cod from this study. However the stomachs they analyzed from the Northern Bering Sea contained benthic organisms as major food items. Craig et al. (1982) report that late winter Arctic cod from Alaskan offshore waters contained copepods, amphipods and fish as important food items but preferred epibenthic mysids as a major food item in summer and winter nearshore waters.

PARASITES

Two digenetic trematodes were also found in the digestive tract. Brachyphallus crenatus was found in a total of 50 fish from both surveys and occurred predominantly in stomachs. Lecithaster sp. occurred in 46 cod from summer and fall surveys. This parasite was found mainly in the intestine. Ocurrence of both parasites are summarized in Table 6.

ACKNOWLEDGMENTS

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Polar Continental Shelf Project provided invaluable assistance with field operations. Also thanks to Mr. J. Ostrick and staff at the Inuvik Research Laboratory for logistic support.

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Table 1. Sampling dates, locations, depths and number of Arctic cod caught during trawling surveys on the Reaufort Shelf, July and September, 1984.

Date	Station	Transect	Start		Finish		Trawl Depth (m)	No. Arctic Cod Sampled
			Latitude	Longitude	Latitude	Longitude		
July 14	8401	A-C	69°49.53'N	132°37.04'W	69°50.70'N	132°37.04'W	10.0	30
July 15	8403	A-C	70°12.41'N	132°21.62'W	70°12.41'N	132°19.00'W	30.0	11
July 15	8403	B-A	70°01.02'N	132°19.87'W	70°01.96'N	132°19.87'W	30.0	2
July 15	8404	A-C	70°17.30'N	131°53.50'W	70°16.10'N	131°49.70'W	30.0	10
July 15	8404	B-A	70°01.02'N	132°19.87'W	70°01.96'N	132°19.87'W	30.0	2
July 24	8409	A-B	69°32.70'N	138°45.00'W	69°31.70'N	138°44.60'W	15.0	3
July 24	8409	B-C	69°31.70'N	138°44.60'W	69°30.70'N	138°44.30'W	15.0	1
Sept. 7	8401	A-B	69°51.80'N	132°54.00'W	69°52.80'N	132°54.00'W	10.7	4
Sept. 7	8401	B-C	69°52.80'N	132°54.00'W	69°52.80'N	132°51.00'W	10.7	9
Sept. 7	8402	A-B	70°04.00'N	132°30.00'W	70°04.00'N	132°26.00'W	22.0	9
Sept. 8	8403	A-B	70°12.00'N	132°22.00'W	70°13.00'N	132°22.00'W	34.0	10
Sept. 8	8403	B-C	70°13.00'N	132°22.00'W	70°13.00'N	132°19.00'W	34.0	4
Sept. 8	8404	A-B	70°21.00'N	131°50.00'W	70°20.00'N	131°50.00'W	35.0	4
Sept. 8	8404	B-C	70°20.00'N	131°50.00'W	70°20.00'N	131°53.00'W	36.0	9
Sept. 9	8405	A-B	70°05.00'N	131°03.00'W	70°06.00'N	131°00.00'W	10.0	9
Sept. 9	8405	B-C	70°05.00'N	131°00.00'W	70°07.00'N	131°06.00'W	11.6	16

Table 2. Occurrence and counts (in brackets) of food items from Arctic cod (Boreogadus saida) caught during July, 1984, from all stations.

		Amphipod remains	Apherusa glacialis	Copepod remains	Calanus sp.	Calanus finmarchicus	Calanus hyperboreus	Eucalanus bungii bungii	Lurytemora sp.	Limnocalanus macrurus	Pseudocalanus elongatus	Crustacea remains	Mysid remains	Mysis litoralis	Mysis relicta	Larval fish	Intestine remains	Stomach remains	Empty
1	PC02												X(1)				X		
2	PC05																X	X	
3	PC06	X(1)															X	X	
4	PC07																X		
5	PC08																X	X	
6	PC09																		X
7	PC11												X(1)				X		
8	PC12																		X
9	PC13																		X
10	PC14																		X
11	PC15														X(1)		X		
12	PC16																		X
13	PC17																		X
14	PC18																X		
15	PC19																		X
16	PC20																		X
17	PC21																		X
18	PC23																		X
19	PC24																		X
20	PC26																X		
21	PC27																		X
22	PC28																		X
23	PC29																		X
24	PC30																		X
25	PC31																		X
26	PC33																X	X	
27	PC34																X		
28	PC36																		X
29	PC37											X	X(1)						
30	PC38										X(1)	X(1)				X(1)	X	X	
31	PC40																X	X	
32	PC43			X(1)													X	X	
33	PC47										X(1)						X		
34	PC48	X(3)	X(1)	X(7)							X(1)								
35	PC52	X(4)		X(1)								X(1)					X	X	
36	PC54	X(1)		X(3)													X		
37	PC59			X(4)			X(19)				X(2)						X		
38	PC61			X(1)				X(1)			X(1)		X(1)				X		
39	PC64			X(8)													X	X	
40	PC68	X(4)		X(2)		X(2)					X(2)						X	X	
41	PC69																		X
42	PC71	X		X													X	X	
43	PC72			X(3)													X	X	
44	PC75		X(1)	X				X(1)										X	
45	PC77	X															X	X	
46	PC78	X		X(1)													X		
47	PC79																X	X	
48	PC80			X(2)			X(4)										X		
49	PC81	X(8)	X(3)	X(5)			X(1)	X(1)									X	X	
50	PC83			X(2)							X(177)						X	X	
51	PC85	X		X													X	X	
52	PC87										X(33)		X(1)				X	X	
53	PC89	X(1)		X(8)	X(1)				X(2)		X(1)						X	X	
54	PC91															X(2)			
55	PC93	X(6)															X	X	
56	PC97																X		
57	PC98	X								X(1)				X(1)			X		
58	PC99			X(8)						X(3)		X					X		
59	PC100																X	X	
Totals	59	13(28)	3(5)	18(56)	1(1)	1(2)	3(24)	3(3)	1(2)	2(4)	9(219)	4(2)	5(5)	1(1)	1(1)	2(3)	36	21	19

Table 3. Occurrence and counts (in brackets) of food items from Arctic cod (Boreogadus saida) caught during September, 1984, from all stations.

		Amphipod remains	Apherusa glacialis	Copepod remains	Acartia longiremis	Calanus sp.	Calanus hyperboreus	Limnocalanus macrurus	Microsetella norvegica	Pseudocalanus elongatus	Crustacea remains	Mysid remains	Mysis relicta	Intestine remains	Stomach remains	Empty
1	PC108							X(24)								
2	PC134							X(43)								
3	PC148							X(3)								
4	PC152							X(21)								
5	PC172							X(31)								
6	PC176			X(18)				X(2)								
7	PC188							X(29)								
8	PC195															X
9	PC196							X(19)								
10	PC197			X(5)				X(1)								
11	PC200							X(39)								
12	PC202							X(45)								
13	PC212			X(1)				X(1)								
14	PC214			X												
15	PC215			X(2)				X(2)								
16	PC216									X(26)						
17	PC217			X						X(45)						
18	PC218			X(1)										X		
19	PC219		X(1)	X(2)		X(1)								X		
20	PC220	X(1)	X(1)	X(1)		X(1)										
21	PC221							X(8)						X	X	
22	PC222	X(1)		X(1)		X(3)								X		
23	PC223		X(1)	X(1)										X	X	
24	PC224			X(5)											X	
25	PC225	X(1)												X		
26	PC226	X(3)		X(5)										X		
27	PC227															X
28	PC228	X(1)	X(1)											X		
29	PC230			X(4)										X	X	
30	PC231			X(2)												
31	PC232	X(4)		X(1)										X	X	
32	PC233															X
33	PC234	X(16)	X(3)											X		
34	PC235	X(1)	X(1)													
35	PC236			X(5)					X(1)							
36	PC237			X(29)												
37	PC238	X(8)									X					
38	PC242															X
39	PC240	X		X(4)						X(1)	X					
40	PC243										X					
41	PC244	X(9)									X			X	X	
42	PC245	X(3)									X			X		
43	PC247										X			X		
44	PC250	X(3)		X(5)							X			X	X	
45	PC253	X(3)														
46	PC255	X		X(1)										X	X	
47	PC257										X			X		
48	PC258			X(27)												
49	PC261													X	X	
50	PC263			X(48)				X(3)				X(1)		X		
51	PC266							X(53)						X		
52	PC268			X(2)				X(65)						X		
53	PC270			X(3)	X(1)			X(1)				X(3)	X(1)	X	X	
54	PC271			X(30)				X(52)						X		
55	PC272					X(8)		X(9)						X		
56	PC274			X(86)										X		
57	PC275											X(1)		X		
58	PC277			X(9)				X(2)						X		
59	PC278			X(4)												
60	PC279			X		X(2)								X		
61	PC281			X(8)		X(1)										
62	PC282			X(11)				X(1)						X	X	
63	PC284						X(5)									
64	PC287	X(1)		X(1)				X(15)						X		
65	PC289	X(3)						X(4)						X		
66	PC290			X(9)										X	X	
67	PC293			X(54)		X(2)		X(12)								
68	PC297			X(21)				X(3)						X		
69	PC298			X(3)				X(20)						X		
70	PC301	X(1)												X		
71	PC302			X(11)		X(4)								X		
72	PC303			X(6)										X		
73	PC304			X(2)										X	X	
74	PC305			X(1)										X		
Totals	74	18(59)	6(8)	41(429)	1(1)	8(22)	1(5)	27(508)	1(1)	3(72)	8	3(5)	1(1)	39	13	4

Table 4. Feeding analysis of Arctic cod (Boreogadus saida) by station during the July, 1984, survey.

Station	Transect	Sample No.	No. Fish Sampled	Food item/empty[1]	Total count	No. of fish containing item/empty
8401	A-C	02-38	30	Amphipod remains	1	1
				Crustacea remains	-	1
				Mysid remains	3	3
				Mysis relicta	1	1
				Digested remains	-	11
				Empty -		18
8403	A-C	40-69	11	Amphipod remains	12	4
				Apherusa glacialis	1	1
				Copepod remains	27	8
				Calanus finmarchicus	2	1
				Calanus hyperboreus	19	1
				Eucalanus bungii bungii	1	1
				Pseudocalanus elongatus	8	6
				Crustacea remains	2	2
				Mysid remains	1	1
				Larval fish	1	1
				Digested remains	-	9
				Empty	-	1
8403	B-A	71-72	2	Amphipod remains	-	1
				Copepod remains	3	2
				Digested remains	-	2
8404	A-C	75-89	10	Amphipod remains	9	5
				Apherusa glacialis	4	2
				Copepod remains	18	7
				Calanus sp.	1	1
				Calanus hyperboreus	5	2
				Eucalanus bungii bungii	2	2
				Eurytemora sp.	2	1
				Pseudocalanus elongatus	211	3
				Mysid remains	1	1
				Digested remains	-	10
8404	B-A	91-93	2	Amphipod remains	6	1
				Larval fish	2	1
				Digested remains	-	1
8409	A-B	97-99	3	Amphipod remains	-	1
				Copepod remains	8	1
				Limnocalanus macrurus	4	2
				Crustacea remains	-	1
				Mysis litoralis	1	1
				Digested remains	-	3
8409	B-C	100	1	Digested remains	1	1

[1]When possible counts of partially digested organisms are included with remains e.g. copepod remains. Digested remains includes stomach and/or intestine remains.

Table 5. Feeding analysis of Arctic cod (Boreogadus saida) by station during the September, 1984, survey.

Station	Transect	Sample No.	No. Fish Sampled	Food item/empty[1]	Total count	No. of fish containing item/empty
8401	A-B	108-152	4	Limnocalanus macrurus	91	4
8401	B-C	172-212	9	Copepod remains	24	3
				Limnocalanus macrurus	167	8
				Empty	-	1
8402	A-B	214-222	9	Amphipod remains	2	2
				Apherusa glacialis	2	2
				Copepod remains	7	7
				Calanus sp.	5	3
				Limnocalanus macrurus	10	2
				Pseudocalanus elongatus	71	2
				Digested remains	-	4
8403	A-B	223-233	10	Amphipod remains	9	4
				Apherusa glacialis	2	2
				Copepod remains	18	6
				Digested remains	-	7
				Empty	-	2
8403	B-C	234-237	4	Amphipod remains	17	2
				Apherusa glacialis	4	2
				Copepod remains	34	2
				Microsetella norvegica	1	1
				Digested remains	-	1
8404	A-B	238-243	4	Amphipod remains	8	2
				Copepod remains	4	1
				Pseudocalanus elongatus	1	1
				Crustacea remains	-	3
				Empty	-	1
8404	B-C	244-261	9	Amphipod remains	18	5
				Copepod remains	33	3
				Crustacea remains	-	5
				Digested remains	-	7
8405	A-B	263-277	9	Copepod remains	178	6
				Acartia longiremis	1	1
				Calanus sp.	8	1
				Limnocalanus macrurus	185	7
				Mysid remains	5	3
				Mysis relicta	1	1
				Digested remains	-	9
8405	B-C	278-305	16	Amphipod remains	5	3
				Copepod remains	131	13
				Calanus sp.	9	4
				Calanus hyperboreus	5	1
				Limnocalanus macrurus	55	6
				Digested remains	-	12

[1]When possible counts of partially digested organisms are included with remains e.g. copepod remains. Digested remains includes stomach and/or intestine remains.

Table 6. Occurrence of the digenetic trematodes, Brachyphallus crenatus and Lecithaster sp., from the digestive tract of Arctic cod caught on the Beaufort Shelf during July and September, 1984.

Parasite	Survey	No. fish with parasite	No. fish with parasite in stomach and intestine	No. fish with parasite in stomach only	No. fish with parasite in intestine only
B. crenatus	July	32	8	23	1
	September	18	1	17	0
Lecithaster sp.	July	25	1	1	23
	September	21	1	1	19

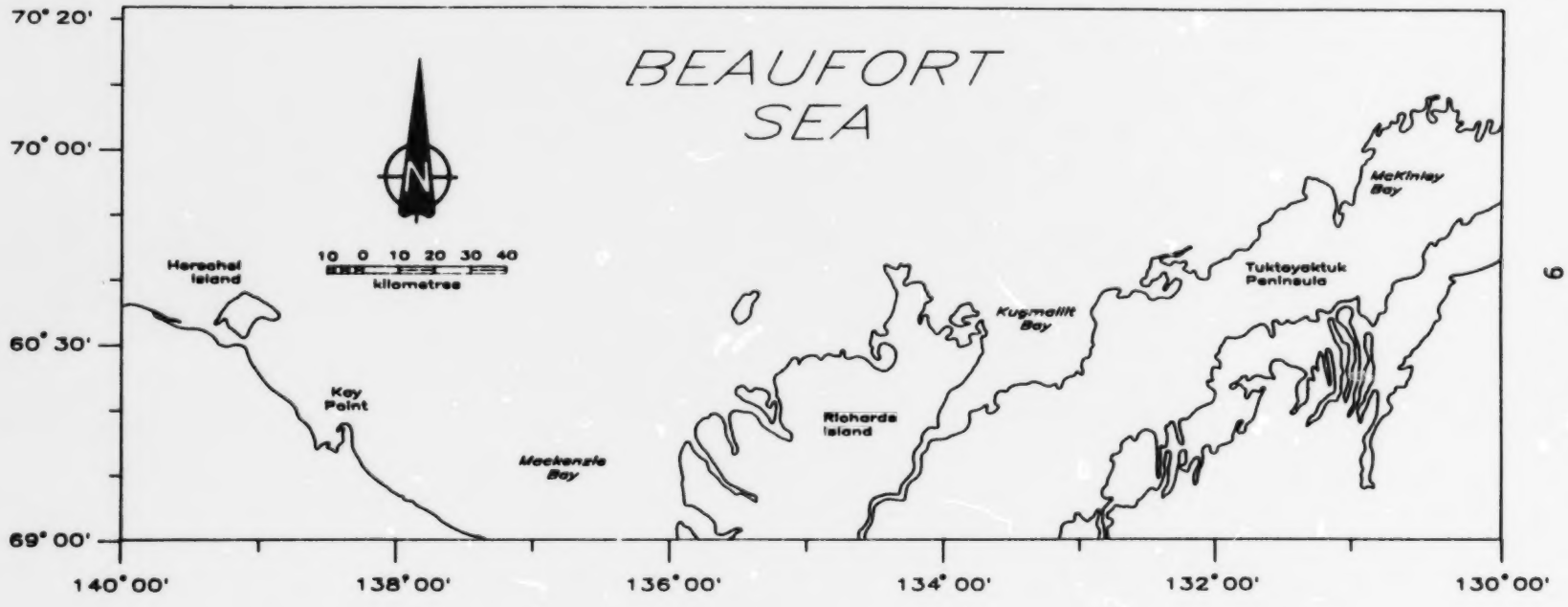

Fig. 1. Study area - 1984 trawling survey.

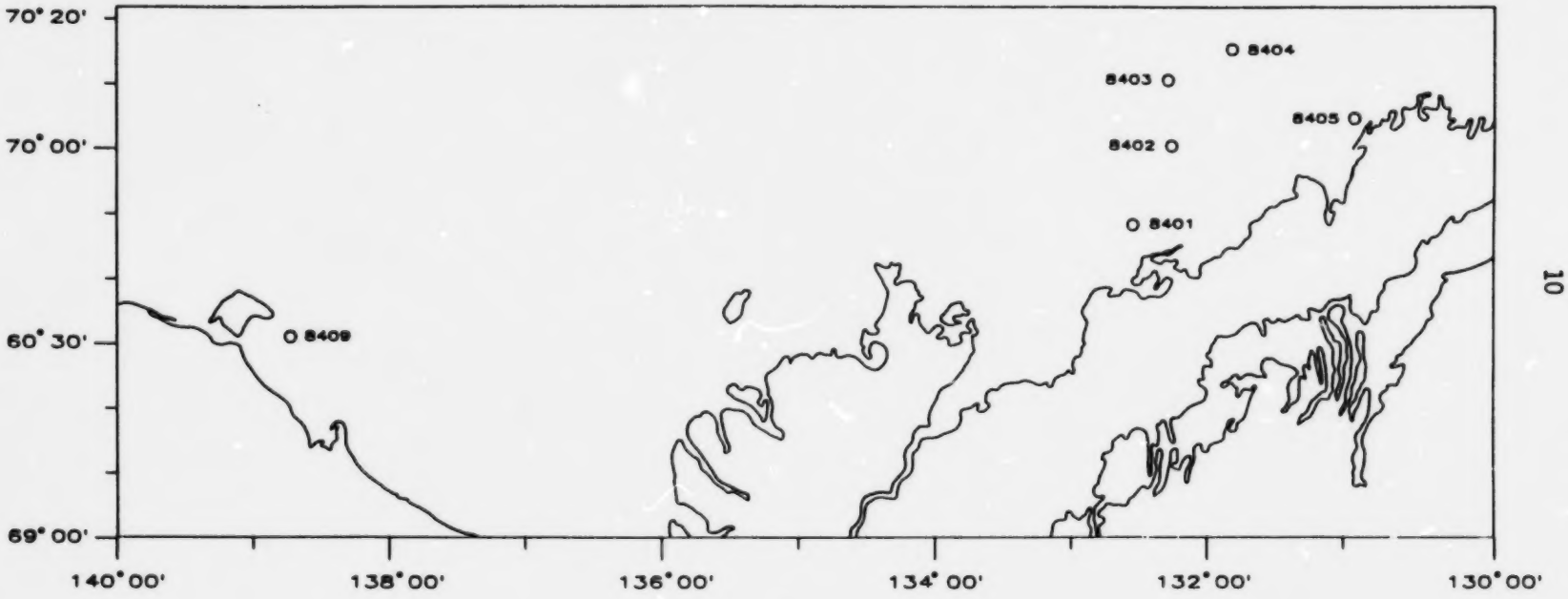

Fig. 2. General locations of Arctic cod catches - July and September, 1984.